CLAIMS

1. A method of calibrating a sampler comprising a plurality (N) of time-interleaved ADCs, said sampler having an input for receiving an analogue input signal and an output for providing a digital output signal, and the method comprising the steps of:

(a) injecting in turn N calibration signals into the input of said sampler such that each calibration signal occupies at least one of N related frequencies, where

the frequency (f) of each of the N related frequencies is given by

$f + k \cdot \frac{f_s}{N}$, where k = 0, 1, 2, ..., N-1

and f_s is the sampling frequency of said ADCs

(b) measuring in the frequency domain the output signal at each of the N related frequencies for each one of the N calibration frequencies; and

(c) determining the relationship that relates the input signal to the output signal at each of the N related frequencies for each one of the N calibration frequencies.

2. A method according to claim 1, wherein in step (a) each calibration signal comprises a single tone.

3. A method according to claim 1 or claim 2, wherein step (b) further comprises performing an FFT of the digital outputs of the ADCs thereby to allow measurement in the frequency domain of the output at each of the N related frequencies.

4. A method according to claim 3, further comprising the step of choosing the first of the N related frequencies such that all the resulting N related frequencies have frequencies substantially centred on bins of the FFT .

5. A method according to claim 3 or claim 4, further comprising the step of repeating steps (a) to (c), injecting in turn N calibration frequencies into the sampler at a different set of N related frequencies.

6. A method according to any of claims 3 to 5, wherein adjacent bins of the FFT are grouped together and a single calibration frequency used for each group.

7. A method according to any preceding claim, further comprising the step of forming a relationship matrix, or a relationship matrix for each iteration of the calibration process, to embody the relationship that relates the input signal to the output at each of the N related frequencies for each one of the calibration frequencies.

8. A method according to any preceding claim, further comprising the step of determining the magnitude and/or phase of the input signal either by independent means or by measuring the magnitude and/or phase in the output of the sampler.

9. A method according to any preceding claim, including in step (a) determining the magnitude and phase of the input signal for each one of the N calibration frequencies, and wherein step (b) comprises measuring in the frequency domain the magnitude and phase of the output at each of the N related frequencies for each one of the calibration frequencies and step (c) comprises determining correction factors from the relationship that relates

magnitude and phase of the output at the N related frequencies to the magnitude and phase of the input signal.

10. A method of performing an analogue to digital conversion using a sampler comprising N time-interleaved ADCs, wherein the sampler has been calibrated in accordance with the method of any of claims 1 to 9, the method of performing an analog to digital conversion comprising the steps of (i) injecting an analogue signal into the sampler; (ii) measuring in the frequency domain the resulting spectrum produced by the sampler; and (iii) adjusting the measured frequency spectrum in response to the relationships determined during calibration thereby to produce a channel-equalised spectrum.

11. A calibration apparatus for calibrating a time interleaved analogue to digital sampler said sampler comprising a plurality (N) of time-interleaved ADCs, said sampler having an input for receiving an analogue input signal and an output for providing a digital output signal, and the apparatus including:

(a) means for injecting in turn N calibration signals into the input of said sampler such that each calibration signal occupies at least one of N related frequencies, where

the frequency (f) of each of the N related frequencies is given by

$$f + k \cdot \frac{f_s}{N}, \text{ where } k = 0, 1, 2, \ldots, N\text{-}1$$

and f_s is the sampling frequency of said ADCs;

(b) means for measuring in the frequency domain the output signal at each of the N related frequencies for each one of the N calibration frequencies; and means for

(c) means for determining the relationship that relates the input signal to the output signal at each of the N related frequencies for each one of the N calibration frequencies.

12. A channel equaliser for an analogue to digital sampler, comprising the calibration apparatus of claim 11, wherein the said means for determining the relationship is operable to adjust a frequency domain signal derived from output of the sampler according to the relationships determined during calibration thereby to produce a channel-equalised spectrum.

13. A computer that is programmed for carrying out the method of any of the claims 1 to 10, and to perform the steps of:

(1) receiving the measurements of the output at each of the N calibration frequencies for each one of the N calibration frequencies;.

(2) determining the relationship that relates the input signal to the output at each of the N related frequencies for each one of the N calibration frequencies.

14. A computer program product comprising program instructions for causing a computer to operate in accordance with claim 13.